

What is claimed is:

1. A method of separating a component from a multi-component gas, comprising:

- (a) providing a flow conduit having a semi-permeable section adapted to selectively permeate the component to be separated in the presence of the multi-component gas flowing therethrough, the flow conduit having a feed side and a permeate side;
  - (b) passing the multi-component gas along the feed side of the flow conduit;
  - (c) providing a sweep gas at a first velocity, the sweep gas being suitable for passage along the permeate side of the flow conduit and being suitable for sweeping the component gas that permeates through the permeable section of the conduit away from the permeate side of the flow conduit, thereby producing a gas mixture comprising the sweep gas and the component gas;
  - (d) accelerating the velocity of the sweep gas so that the velocity of the sweep gas along at least a portion of the permeate side of the flow conduit is greater than the first velocity of the sweep gas; and
  - (e) decelerating the gas mixture by means of a defuser, thereby recovering as pressure a portion of the energy of the gas mixture.
2. The method of claim 1 wherein the multi-component gas is natural gas.
3. The method of claim 1 wherein the sweep gas is accelerated to supersonic velocity.
4. The method of claim 1 wherein the step (e) of decelerating the gas mixture is carried out by passing the gas mixture through a supersonic diffuser.

-14-

5. The method of claim 1 wherein the multi-component gas is rich in methane and contains CO<sub>2</sub> and the CO<sub>2</sub> is the component being permeated through the semi-permeable section, and the sweep gas is lean in CO<sub>2</sub>.
6. A membrane separation system for separating one or more components from a multi-component gas, comprising:
  - (a) a first flow conduit longitudinally positioned inside a portion of a second flow conduit, the first conduit adapted for flow of the multi-component gas therethrough, the first flow conduit having a semi-permeable membrane for permeation therethrough of one or more components of the multi-component gas;
  - (b) the second conduit adapted for passage of a sweep fluid to facilitate removal of permeate on the permeate side of the membrane, the second conduit having a first area followed by a smaller second flow area, the second flow area being concentric to at least a portion of the membrane; and
  - (c) the second conduit having a third flow area in a downstream direction of the second flow area, the third flow area being greater than the second flow area.
10. The membrane separation system of claim 6 wherein the second flow area continuously decreases concentrically along a substantial portion of membrane portion of the first conduit.
15. The membrane separation system of claim 6 wherein the second flow area decreases to a fourth flow area and then increases to a fifth flow area, the fifth flow area being concentric over a substantial portion of the membrane portion of the first conduit.

-15-

9. The membrane separation system of claim 8 wherein the fifth flow area decreases in area to a sixth flow area in the downstream direction of the second conduit, the sixth flow area being substantially the same at the fourth flow area.